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ABSTRACT

The quantitative methods of regression and factor analysis were used to study the equity of educational outcome and the effectiveness of schools in 30 sixth-grade classrooms in western New York State. Equity of educational outcome refers to a situation in which educational achievement is fairly and justly distributed across racial and socioeconomic boundaries. The reading scores of the participating students (N=744) on the New York State Pupil Evaluation Program (PEP) test of May 1987 were used to define the relationship between student achievement and background. To study the relationship between equity of educational outcomes and school effectiveness, the dependent variable was the value that described the association between achievement and background. School effectiveness was studied using a set of school input variables often associated with educational achievement. The strength of the relationship between student achievement and background varied considerably from one classroom to another. Findings on school effectiveness suggest that some variables conventionally used in effectiveness studies may not be positively related to the equity of educational outcomes. Implications for reducing inequities are discussed. Factor analysis and multiple regression techniques appeared appropriate for studies of educational equity. Six tables present study data. (SLD)

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Equity of Educational Achievement and School Effectiveness

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Equity of Educational Achievement and School Effectiveness

Introduction

The targets of the school improvement efforts that are underway all around the country can be described to a large extent in two words: effectiveness and equity. The meaning of "effectiveness" seems to be relatively easily agreed upon, albeit the actual definitions may vary: Most people associate effectiveness with the attainment of high standards in educational achievement. With regard to the meaning of "equity," there is less agreement. Even though the word is commonly used, it has rarely been clearly defined or empirically investigated outside the area of educational financing. In the terminology of this particular field, the concept of equity refers to the degree of fairness in the distribution of financial resources to school districts. The term "fair" is used as a descriptor for a property of a distribution that accounts for differences between communities in their ability to raise funds for education.[1] It should be noted that the principle of equity does not require that funds be equally distributed.

It has been suggested that these two issues, effectiveness and equity, are intertwined: truly effective schools are also effective in reducing inequalities in educational achievement.[2] In fact, effectiveness has been defined in this manner, that is, as the ability of schools to help the disadvantaged. An instructionally effective school, according to Ronald Edmonds, is one that

> brings the children of the poor to those minimal masteries of basic school skills that now describe minimally successful pupil performance for the children of the middle class.[3]

The notion of effectiveness that has been outlined above implies that the differences in the distribution of educational achievement across, for example, socioeconomic and racial boundaries are, at least in part, a result of educational policy decisions and, consequently, what goes on in schools. Researchers on school effectiveness have identified a number of school characteristics that are generally related to student achievement. In addition, it has been suggested that these effective school attributes are especially associated with the academic achievement of the disadvantaged.[4] As a consequence, student achievement in schools where the effective school characteristics are present to a considerable extent is assumed to be less related to students' background than in those schools where these properties are not found to the same degree.

Since the notion of equity has been widely used in the context of assessing the appropriateness of the distribution of financial resources to school districts, it is, therefore, generally associated only with educational inputs. However, one can justifiably argue that focusing only on the equity of inputs is not appropriate because the end results of education are ultimately more important than the means by which they are achieved. Thus, it would seem more appropriate to define standards such as equity in terms of educational outputs than in terms of inputs and to set the goals of educational policy decisions accordingly. To that end, the concept of equity in education as it is used in this inquiry is defined in terms of the relationship between students' achievement and their background.

Given these two concepts, the equity of educational outputs and the effectiveness of schools as the framework, the purpose of this study was two-fold: first, to advance the application of quantitative methods, namely regression analysis and factor analysis, as means for investigating such an abstract entity as the equity of educational outputs, and second, utilizing this methodology, to

conduct a limited inquiry into the equity of educational outcomes and the effectiveness of schools in producing such results.

The problem of the study was: Is the distribution of academic achievement more equitable in the classrooms where selected school input variables are present to a greater extent than in the classrooms where they are not found to the same degree?

This inquiry resembles traditional school effectiveness studies in that it is an investigation of the relationship between school inputs and student achievement. However, it differs from them in an important aspect. The notion of effectiveness in this study incorporates the idea of equity as a measure of educational outputs. In this way, these two issues that are of great interest to many are linked together in the conceptual framework of the study.

Equity in Education

Among the very few attempts that have been made to define the notion of equity in education as a general term, are the definitions by Thomas Green and Ken Alexander. In the main, their notions of equity associate it with justice and fairness. According to Green, the idea of equity refers to "a random distribution of resources, attainment, and educational achievement in respect to variables irrelevant to educational justice."[5] The educationally relevant variables are choice, ability, and virtue. Factors such as sex, social class, or race are educationally irrelevant.

In his definition of equity, Kern Alexander suggests that "equity in its broadest sense encompasses justice, equality, humanity, morality, and right."[6] When elaborating on the meaning of the term, he notes that equity is more than equality. He maintains that an affirmative response to social inequalities is

essential for achieving equity. According to Alexander, equity "in a broad sense, may be coextensive with the wide moral expanse of natural law and Western man's ideals of charity, but in a more restricted sense the term may be presumed to espouse simple justifiable fairness."[7]

As a general concept, equity can be understood as a matter of distributing social goods in a just, ethical, and socially valuable manner. Needless to say, the definitions of "social goods," "justice," "ethics," and "socially valuable manner" in this context are very important in characterizing the concept of equity. "Social goods" here refer to all outcomes and results of human interaction. Each of the three other concepts is briefly discussed in the following.

Equity in Relation to Justice, Ethics, and Social Values

One of the broadly recognized definitions of justice is that of John Rawls. According to his view, justice consists of two principles. The first principle of justice is:[8]

> Each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all.

His second principle of justice reads:

> Social and economic inequalities are to be arranged so that they are both: (a) to the greatest benefit of the least advantaged... and (b) attached to the offices and positions open to all under conditions of fair equality of opportunity.

Two distinct characteristics of justice emerge from this definition: first, justice encompasses the notion of equality, but only in terms of basic rights and liberties,

and second, the definition recognizes that inequalities exist in society and that they are acceptable as long as they do not promote discrimination.

John Rawls' definition of justice constitutes the basis for the notion of equity, as defined here, for the following reasons: first, justice implies a duty to act for common good, and second, Rawls' definition supports the need for differentiation among individuals. It acknowledges the principle of equality among individuals, but only insofar as the basic liberties are concerned. Otherwise, it advocates the recognition of the rights of the disadvantaged. In this respect, Rawls' notion of justice has a positivistic character as Kern Alexander has also pointed out.[9] That is to say that justice, according to Rawls, not only allows an unequal distribution of social goods as long as it operates for the benefit of the less fortunate, but also encourages affirmative philosophy.

From an ethical standpoint, the concept of equity in education encompasses the notion that society has a responsibility for optimizing alternatives for every individual, including those who are less fortunate than others. This duty is essential not only as an ethical principle, but also as a principle of justice as understood by Rawls. Furthermore, an argument has been made that, in our society, there is an almost universally adopted moral code that people should be fair and equitable in their dealings with each other.[10] The notion of equity appears to demand that fairness should be extended to all aspects of social interaction. To be fair, however, requires at times more than that the distribution of social goods is left to chance. The principle of fairness, understood in this way, includes the idea of purposefully working toward an equitable distribution.

The notion of equity also espouses the idea that society has a moral duty not only for compensating for the unfairness of fate, but also for ensuring that it is done in a systematic manner. That is to say that receiving an equitable share should not be a matter of chance--for example, due to the fact that a person

happens to live in a certain place. It appears that society does not consider it to be ethically correct if an educational policy or practice is dependent on factors such as the wealth of the neighborhood. This argument, known as the principle of fiscal neutrality, has been upheld by the nation's courts in school finance litigation.[11] Extending the argument, the concept of equity implies that a similar policy should prevail in all aspects of education. Thus, a fair distribution of educational attainment--regardless of the circumstances--is the essence of equity viewed from an ethical standpoint.

It is evident that many people share certain beliefs about what is socially valuable. Social order, individual liberties, cultural diversity, freedom of choice, democracy, private enterprise, and religious rights are just a few examples of the ideas that might be included in the social value system of many people. To characterize the relationship between equity and social values as it is understood here, three socially valuable entities are thought to be particularly relevant.

The first one, the belief that individual freedom to make choices and bear consequences thereof, is one of the most fundamental treasures in democracy. In education, this liberty manifests itself in differences of aspiration and achievement.

Cultural pluralism is another social value that is associated with the notion of equity. A culturally pluralistic society has been defined as one that "boasts a diversity of racial, religious, cultural, or ethnic groups that coexist and interact" in harmony.[12]

Akin to racial, cultural, and ethnic diversity is the value related to the status that such minorities as the handicapped or the educationally disadvantaged should have in a society. As is well known, the rights of these groups have been in the focus of public attention in recent years. The fact that society appreciates

the rights of the disadvantaged is, therefore, an essential characteristic of the social values related to equity.

In summary, the notion of equity in this study is understood as a matter of adherence to principles of justice, ethics, and social values in the distribution of social goods. Thus, equity represents a manifestation of a universal, humanistic consideration for society as a whole. When applied in education, the notion of equity implies that the moral code of fairness in society should be reflected not only in equal access to, or in equal opportunity for education, but also --and more importantly--in the distribution of educational outcomes. Equity of educational outcomes refers to a situation in which educational achievement is fairly and justly distributed across racial and socioeconomic boundaries. The definition implies that the less student achievement is related to background, the more equitable it is.

Methodology

Operationalization of the Key Concepts

The notion of equity, conceptualized as the relationship between students' achievement and their background, is a relative term. As such, it does not have absolute values. In this sense, one can only state that a distribution of educational achievement is either more or less equitable than another. It is not possible using this notion to set a definite cut-off point between equitable and inequitable distributions. The degree of fairness depends on how much of the students' achievement is determined by their background characteristics and how much of it is determined by other factors such as school inputs. If the distribution of educational achievement is strongly related to the students' background, the degree of equity is--by definition--low. However, if the relationship between students' background and achievement is weak, the outcome is more equitable than in the former case--in other words, the degree of fairness of the distribution is greater. Operationally, the distribution of educational achievement is defined as equitable if the student background variables explain a relatively small proportion of the variance in students' achievement in a regression analysis when the achievement scores are regressed on the background variables.

Educational effectiveness in this study is understood as the property of schools being able to produce equitable educational outcomes. Again, it is not possible using this notion to state in absolute terms what constitutes an effective school. A school is only more or less effective in relation to another school.

Hypotheses

The hypotheses for this study were:

H1: There will be observable differences in the strength of the association between students' reading achievement scores and the student background variables as indicated by the obtained R^2 values when the achievement scores are regressed on the background variables.

H2: The variation in the R^2 values obtained in testing the first hypothesis will be associated with the school input variables.

The unit of analysis was the student in testing the first hypothesis and the classroom in testing the second hypothesis.

Subjects

The subjects of the study were pupils in 30 sixth grade elementary school classrooms in Western New York State in which the teachers volunteered to participate. Summary data on the classrooms regarding class size, percent of minority students, percent of PSEN students (Pupils with Special Educational Needs), percent of students receiving free or reduced price lunch, and average ability score are presented in Table 1.

TABLE 1

Summary Data on Participating Classrooms					
CLASSROOM	NUMBER OF STUDENTS	% OF MINORITY	% OF PSEN	% OF LOW SES	AVG. ABILITY
1	25	4	0	0	132.5
2	29	10	3	0	115.4
3	25	8	0	0	135.7
4	21	0	14	10	101.7
5	28	7	0	0	111.9
6	24	0	0	4	119.7
7	24	4	13	13	104.7
8	29	0	10	7	115.5
9	29	7	3	0	115.3
10	23	0	9	4	112.5
11	21	4	4	0	102.3
12	22	0	0	0	112.1
13	25	32	60	20	104.7
14	25	28	36	16	108.4
15	27	26	19	15	110.9
16	20	15	20	0	110.5
17	20	30	30	20	108.4
18	20	20	20	5	110.9
19	26	8	19	4	112.9
20	26	15	8	12	117.2
21	25	4	32	4	110.8
22	26	19	15	12	116.3
23	27	15	7	11	115.8
24	27	11	19	19	107.7
25	24	13	17	4	109.4
26	26	0	8	8	119.3
27	27	0	15	30	110.8
28	27	0	0	19	113.0
29	20	0	0	25	99.1
30	26	4	4	0	117.0
AVG	24.8	9.5	12.8	8.7	112.7

The teachers who participated in the study were experienced educators. The average number of years in teaching for these teachers was 20.6 years, the least experienced teacher having taught for ten years and the most experienced teacher for 29 years. Most of the teachers were also well trained judging from the amount of training they had received after becoming teachers, 11.5 hours on average in teaching methods and 2.5 hours in the content of the subject taught. Since the

participation in the study was voluntary for the teachers, the classrooms may not be representative of any particular population. As a result, the findings reported here may not be generalized beyond this group of classrooms.

Dependent Variables

The dependent variable in determining the relationship between student achievement and background (Hypothesis H1) was student achievement in reading on the New York State Pupil Evaluation Program test administered in May, 1987.

In investigating the relationship between the equity of educational outcomes and school effectiveness, the dependent variable for testing Hypothesis H2 was the R^2 values that described the association between student achievement and background.

The student achievement scores in reading on the New York State Pupil Evaluation Program (PEP) test in May of 1987 were obtained from the school districts' files or supplied by the teacher of the participating classroom. The PEP tests are achievement tests administered to all third and sixth grade non-handicapped students in New York State every May. The scores on the reading test can vary from 0 to 77. According to the State Education Department, these tests meet conventional standards for validity and reliability. The reading tests correlate highly with norm-referenced reading tests ($r > .80$) and have a high parallel form reliability ($r > .85$).

Independent Variables

The independent variables for testing Hypothesis H1 were four student characteristics that have been found to explain a large portion of the variance in student achievement in other studies.[13]

1. Student race--indicated by the student's status of being classified as either white or non-white.
2. Student's educational needs -- indicated by the student's status of being classified as a PSEN student or not, that is, a Pupil with Special Educational Needs.
3. Student's socioeconomic background--indicated by whether a student received a free or reduced price lunch or not.
4. Student ability--indicated by student's ability test score.

Three of the background characteristics, race, socio-economic status, and educational needs are "dummy" variables. Race is indicated as white (the code in the data analysis = 1) or non-white (0), socio-economic status is indicated as a student receiving (1) or not receiving (0) a free or reduced price lunch, and educational needs are indicated as a student's status being classified (1) or not being classified (0) as a PSEN student. Intellectual ability, however, is a student's actual score on the Otis-Lennon Mental Ability Test.

One might justifiably argue that these indicators are only proxies and do not accurately reflect students' background. That is especially true about educational needs and socio-economic status. The educational needs of the students certainly encompass much more than the classification as a PSEN student. Similarly, the term "socio-economic status" is definitely much more inclusive than a student

receiving or not receiving a free lunch. A more appropriate term for describing student background in this regard would perhaps have been "economic disadvantage." However, for the purpose of being as consistent as possible with the generally used terminology of school effectiveness studies, the student background variables were named as indicated above.

Information for the student background variables was also obtained from the districts' files or supplied by the teachers. The test that all of the districts involved in the study used for measuring student ability was the Otis-Lennon Mental Ability Test.

The independent variables for testing Hypothesis H2 comprised a set of school input variables that have either been associated with educational achievement in other studies[14] or were assumed by this researcher to have such a relationship in this inquiry. The abreviated names of these variables, if any, and their corresponding symbols that are used in the presentation of the findings and in the subsequent discussion are included in parentheses. The independent variables were:

1. The number of years that the teacher had been teaching (Teacher experience = Yrs)
2. Training in teaching methods that the teacher had received (Training in teaching methods = Tr met)
3. Training of the teacher in the content area, e.g., reading as a process (Training in the content area = Tr cont)
4. Time allocated for reading per day (Time alloc)
5. Teacher's estimate of the time students actually were engaged in reading per day (Time eng)

6. Teacher's estimate of the time students spent in guided practice of reading (Practice)
7. Teacher's estimate of the time students spent in homework per day (Homework)
8. Number of students in the classroom (Class size)
9. Classroom climate (Climate)
10. Teacher's expectations (Expect's)
11. Teacher's and students' commitment to improve (Commitm)
12. Teacher's perception of the principal's expectations (Prin exp)
13. Teacher's perception of academic futility (Futility)

Data for the independent variables of the study were supplied by the teacher of each participating classroom as a result of completing the study questionnaire. The teachers were asked to respond to eight questions related to their experience, training, and the characteristics of the instructional programs in their classrooms. Their answers provided data for the first eight variables listed above. In addition, they responded to 44 questions developed by Wilbur Brookover and his associates[15] for the purpose of measuring classroom climate and teachers' expectations, teachers' and students' commitment to improve, principal's expectations, and teachers' perceptions of academic futility. These answers provided the data for the variables 9 through 13.

The teacher questionnaire was pilot-tested in one of the participating school districts. All 26 fifth grade teachers in this district were asked to fill out the questionnaire prior to the actual data collection. (These data were not included in the final study.) The purpose of the pilot-testing was two-fold: first, to revise or refine any unclear or misleading questions and, second, to obtain a reliability estimate for the collected data. For the latter purpose, the teachers filled out the questionnaire twice with a three-week time period in between. The results

indicated that the average test-retest reliability of the items in the instrument was in a moderate range, .69. The section in which the teachers provided answers about their instructional program was less reliable (.58) than the section developed by Brookover (.74).

For the purpose of reducing the dimensionality of the independent variables and for identifying possible underlying factors, an exploratory factor analysis of the school input variables was conducted. The results of the factor analysis suggested that three common underlying factors might have been responsible for the covariance of seven independent variables to a degree that would justify the use of these factors rather than the individual variables in subsequent analyses. The variables were:

1. Training in the content area,
2. Time engaged in reading,
3. Homework,
4. Classroom climate,
5. Teacher's expectations,
6. Commitment to improve, and
7. Principal's expectations.

The correlation matrix, eigenvalues, and rotated final solution of the factor analysis are presented in Table 2.

TABLE 2

Correlation Matrix, Eigenvalues and Rotated Factor Loadings of the Factored Variables

Correlation matrix

	Tr cont	Time eng	Homework	Climate	Expect's	Commitm	Prin exp
Tr cont	1						
Time eng	-.176	1					
Homework	-.266	.243	1				
Climate	-.045	.313	.254	1			
Expect's	.084	.306	.050	.748	1		
Commitm	.029	-.139	.220	.329	.242	1	
Prin exp	-.165	.033	.438	.556	.345	.437	1

Eigenvalues

Value 1	2.469
Value 2	1.480
Value 3	1.326
Value 4	.907

Orthogonal Transformation Solution Varimax

	Factor 1	Factor 2	Factor 3
Tr cont	.055	-.661	.064
Time eng	.509	.499	-.507
Homework	.074	.792	.290
Climate	.882	.149	.318
Expect's	.925	-.133	.117
Commitm	.150	-.021	.767
Prin exp	.340	.401	.729

The remaining independent variables, "Teacher experience," "Training in teaching methods," "Time allocated for reading," "Practice," "Class size," and "Futility" did not appear to fit the factor structure as indicated by low factor loadings for the variables. Three of the obtained factors had eigenvalues larger than 1, which value was set as the limit for inclusion in the following regression analyses. Factor scores from an orthogonally rotated Varimax solution were substituted for the original values of the seven factored variables in testing Hypothesis H2. The scales of all three factors were in the same direction as those

of the original variables, in other words, when the values of these variables increased, the factor scores also increased.

The naming and interpretation of the factors was very difficult because the factor loadings did not appear to represent any easily recognizable underlying components. Factor # 1 was called "The Classroom Climate and Expectations" factor because of the relatively high loadings (.882 and .925, respectively) for the two variables representing classroom climate and teacher expectations. Factor # 2 was called "Emphasis on hard work" due to the .499 and .792 loadings for the variables "Time engaged in reading" and "Homework," respectively. Factor # 3 was named "Teacher morale" based on the relatively high loadings of .767 and .729 for the variables "Commitment to improve" and "Principal's expectations", respectively. The negative .661 loading of the factor, "Emphasis on hard work," for the variable "Training in the content area" is hard to explain and it could just be idiosyncratic for this particular group of subjects.

The thus revised list of the school input variables used in the study is presented below.

1. Teacher experience,
2. Training in teaching methods,
3. Time allocated for reading,
4. Practice,
5. Class size,
6. Futility,
7. Classroom climate and expectations (Clim/exp),
8. Emphasis on hard work (Hard work), and
9. Teacher morale (Morale).

RESULTS

Testing Hypothesis H1

Hypothesis H1 was tested by regressing the student achievement scores in reading on the student background variables in each participating classroom. The model specification for the regression analysis was based on the assumption that the student background variables would be associated with student achievement. The obtained R^2 values were adjusted to account for differences in the number of students in these classrooms and for differences in the number of student background variables, which varied from one to four. The adjustment was made according to the following formula:[16]

$$\hat{R}^2 = \left(R^2 - \frac{k}{n-1}\right)\left(\frac{n-1}{n-k-1}\right)$$

In the formula, n stands for the number of subjects and k stands for the number of independent variables included in the regression analysis. The difference in the number of student background variables in this study was the result of the fact that, in some classrooms, there was no variance in race, PSEN, or SES status. All four background variables were present in 14 of the 30 classrooms, but in Classroom 12 (Table 1), for example, there was only one variable to describe the students' background (in this case, ability). In two classrooms, numbers 3 and 14, the R^2 values after adjustment were negative. This is obviously due to the mathematics in the adjustment formula and does not have any basis in reality because a negative R^2 coefficient implies that less than zero percent of the variance was explained. The adjusted R2 coefficients were used in testing Hypothesis H2, including those with the negative signs even though these two

do not make any conceptual sense. The R^2 values from the regression analyses between student achievement and their background are presented in Table 3.

TABLE 3

Proportion of Variance in Reading Achievement Explained by Student Background

Classroom	R^2	
	Unadjusted	Adjusted
1	.38	.31
2	.49	.42
3	.02	-.09
4	.65	.53
5	.13	.04
6	.50	.43
7	.50	.39
8	.70	.67
9	.62	.58
10	.67	.61
11	.65	.60
12	.08	.02
13	.34	.19
14	.10	-.11
15	.45	.35
16	.61	.53
17	.68	.57
18	.46	.29
19	.51	.40
20	.48	.37
21	.64	.55
22	.33	.19
23	.50	.40
24	.36	.24
25	.45	.34
26	.55	.48
27	.45	.38
28	.30	.23
29	.39	.25
30	.49	.41
Average	.45	.35

The range of the R^2 values was relativeiy wide, from .02 to .70 for the unadjusted coefficients (-.11 to .67 after the adjustment). These results support Hypothesis H1. In one classroom (Classroom 8), as much as two thirds of the variance in reading achievement was explained by student background; in some

others (Classrooms 3, 12, 14), student background was hardly at all related to achievement. When student background variables were individually considered, the b-weight for student ability was statistically significant ($p < .05$) in 17 of the 30 classrooms (Table 4).

TABLE 4

The b-weights and t-statistics for the Background Variables

Class-room	Race		PSEN		SES		Ability	
	b	t	b	t	b	t	b	t
1	-3.32	-1.32					0.20	3.40 *
2	8.04	1.29	-9.62	-1.57			0.29	2.85 *
3	0.51	0.27					0.04	0.57
4			-2.85	-0.48	-17.53	-1.74	0.60	2.17 *
5	1.17	0.23					0.34	1.72
6					0.60	0.16	0.46	3.98 *
7			-17.67	-2.65 *	-2.67	-0.34	0.56	1.75
8			-13.87	-3.14 *			0.35	3.63 *
9	0.56	0.17					0.41	5.51 *
10			-5.05	-0.53	-3.43	-0.28	0.81	4.79 *
11	-1.81	-0.30					1.07	4.90 *
12							0.28	1.12
13	-12.55	-1.89	-21.64	-2.65 *	-4.47	-0.59	-0.35	-0.67
14	-1.65	-0.57	-0.20	-0.07	-2.67	-0.69	0.08	0.76
15	-5.53	-1.40	-6.97	-1.48	-5.09	-1.06	0.35	2.73 *
16	-2.07	-0.52	-2.78	-0.63			0.41	3.31 *
17	0.64	0.17	-10.70	-2.61 *	-2.45	-0.56	0.17	1.25
18	-2.12	-0.50	-7.73	-1.70	2.42	0.30	0.22	1.75
19	-5.03	-0.53	0.29	0.04	2.59	0.24	0.71	3.22 *
20	1.10	0.14	-28.91	-3.67 *	-0.99	-0.15	0.13	0.58
21	-6.65	-0.99	-6.35	-1.76	-19.91	-2.72 *	0.30	2.07 *
22	4.03	1.10	-5.70	-1.34	0.28	0.07	0.14	1.19
23	-0.10	-0.02	-16.97	-3.17 *	0.34	0.08	0.14	1.17
24	15.01	2.22 *	-13.62	-2.30 *	-6.38	-1.19	-0.12	-0.46
25	0.88	0.16	-8.33	-1.59	2.48	0.23	0.48	2.56 *
26			1.30	0.40	2.80	0.92	0.35	4.67 *
27			-2.24	-0.63	-3.07	-1.09	0.46	3.60 *
28					0.28	0.06	0.46	3.03 *
29					-0.66	-0.11	0.71	2.38 *
30	3.04	0.45	-22.97	-3.31 *			0.20	1.39

*$p < .05$

In ten classrooms, the b-weights for either race (1 classroom), PSEN status (8 classrooms), or SES (1 classroom) reached the conventional level of statistical significance ($p < .05$). The b-weight for PSEN-status was statistically significant in

classrooms 7, 8, 13, 17, 20, 23, 24 and 30. Race explained a significant proportion of the variance in achievement in classroom 24 and SES had a significant regression coefficient in classroom 21.

The signs of the b-weights were, however, inconsistent. For example, in two classrooms, number 13 and 24, the regression coefficient for ability was negative. Similarly, the signs of the b-weights for the other background characteristics varied without any seemingly logical pattern. These regression coefficients are difficult to interpret. Some of them are a result of the so-called "suppressor effect" in regression analysis. This term refers to a situation in which an independent variable obtains a regression weight that has a sign opposite to the actual correlation between the dependent variable and this particular independent variable. The suppressor effect is a result of the intercorrelations among the regressed variables. It occurs when the actual correlation between the dependent variable and the suppressor variable is low and the other predictor variables in the regression explain a relatively larger proportion of the variance than this particular variable.

This effect was clearly present in classrooms 13 and 24 for ability, in classrooms 6, 22, and 23 for SES, and in classrooms 19 and 26 for PSEN. The rest of the unusual signs were probably just plain idiosyncracies of these particular classrooms. Even though these coefficients are incidental for testing Hypothesis H1 and do not have any bearing on the principal findings of the study, they nevertheless warrant further consideration.

Testing Hypothesis H2

Hypothesis H2 was tested by regressing the obtained R^2 values on the school input variables. The model specification for the regression analysis was based on the assumption that this particular operationalization of equity is, at least to a degree, a function of the school input variables. The summary results of testing Hypothesis H2 are presented in Table 5.

TABLE 5

Results of the Multiple Regression Analysis Between School Input Variables and Equity

DF:	R:	R-squared:	Adj. R-squared:	Std. Error:
29	.793	.628	.461	.152

Analysis of Variance Table

Source	DF:	Sum of Squares:	Mean Square:	F-test:
REGRESSION	9	.778	.086	3.755
RESIDUAL	20	.461	.023	p = .007
TOTAL	29	1.239		

Regression Coefficient Table

Parameter:	Value:	Std. Err.:	Std. Value:	t-Value:	Signific.
Intercept	-.867				
Yrs	.029	.010	.718	2.847	p<.05
Tr met	.010	.002	1.036	4.462	p<.001
Time alloc	-.002	.002	-.247	-1.151	NS
Practice	.011	.004	.488	3.057	p<.01
Class size	.025	.013	.331	1.882	NS
Futility	-.014	.008	-.254	-1.706	NS
Clim/exp	.079	.034	.381	2.318	p<.05
Hard work	.120	.040	.583	3.045	p<.01
Morale	.015	.038	.074	0.400	NS

NS = not significant

The obtained R^2 of .63 (.46 after adjustment) indicates a relatively strong association between the school inputs and equity. However, the direction of this

relationship was completely opposite to what was expected for eight of the nine variables.

According to Hypothesis H2, the school input variables would be associated with the R^2 values from testing Hypothesis H1. If these variables, including the factors, were to contribute to equity, they should have had negative regression weights indicating that when the value of a school input goes up, the value of the R^2 goes down and equity increases. The only exception in this regard was the variable "Futility" which was scaled in such a way that if it were to be positively associated with equity, a smaller value of this variable would be associated with a smaller value of the R^2 and, thus, have a positive sign.

However, the only variable that was directly associated with equity was "Time allocated for reading" but this relationship was not statistically significant. The rest of the school input variables were not directly associated with equity. In fact, five of them, "Teacher experience," "Training in teaching methods," "Practice," "Climate and expectations," and "Hard work" had statistically significant inverse regression coefficients.

When the correlations between the dependent variable and each independent variable were individually examined for the purpose of detecting possible suppressor effects, two of the above mentioned variables, "Teacher experience" and "Hard work" had an actual correlation with the dependent variable that was negative. The positive b-weights for these two variables were, therefore, a result of the suppressor effect. The intercorrelations of the variables in the regression analysis are presented in Table 6.

TABLE 6

Correlation Matrix for School Input Variables and Equity										
Variable	Yrs	Tr met	Time alloc	Practice	Class size	Futility	Clim/ exp	Hard work	Morale	Equity
Yrs	1									
Tr met	-.441	1								
Time alloc	-.589	.080	1							
Practice	-.346	.007	.307	1						
Class size	-.142	-.148	.092	-.057	1					
Futility	-.013	.039	.123	-.032	.306	1				
Clim/exp	-.423	.065	.394	.285	.131	.108	1			
Hard work.	-.192	-.400	.389	.080	-.084	-.077	.001	1		
Morale	.135	-.253	-.390	-.161	-.274	-.290	-.001	-.001	1	
Equity	-.068	.417	-.090	.303	-.073	-.193	.201	-.035	-.090	1

The three other significant but inverse regression coefficients could not be explained by the suppressor effect. (The positive b-weights for two other variables, "Class size" and "Morale," although statistically not significant, were due to the suppressor effect. One variable, "Futility," was neither statistically significant nor affected by this effect.) Even though the expected direction of the relationship did not hold for eight of the nine independent variables, the proportion of variance explained by them, 46 percent, was relatively large and statistically significant at the $p < .05$ level.

The findings of the study in testing Hypothesis H2 were, then, that the school input variables explained a statistically significant proportion of the variance in equity, but that none of these variables was positively and statistically significantly related to equity. Actually, three variables, "Training in teaching methods," "Practice," and "Climate and expectations," were negatively and statistically significantly associated with it. These variables, also, had an actual inverse correlation with equity.

DISCUSSION

Methodological Outcomes

This study was--at least in part--an exploratory inquiry into using quantitative methodology in studying the relationships among student achievement, background, and school inputs. The emphasis in the study was to advance the application of multiple regression analysis and factor analysis in investigating the equity of educational outcomes and school effectiveness.

The use of multiple regression analysis in school effectiveness studies is nothing new. It has been traditionally used in these inquiries because it offers a convenient way of examining the relationship between several variables simultaneously. In this study, multiple regression analysis was first employed for determining the relationship between student achievement and background. In addition to this conventional use, however, multiple regression analysis also served another purpose in this study. It provided the operational definition of the key concept, the equity of educational outcomes, as the R^2 values that described the relationship between student achievement and background. These coefficients, in turn, became the dependent variable in the subsequent analysis of the association between equity and school inputs.

In the traditional school effectiveness studies, the thrust of the efforts has been to identify those individual school inputs that could be firmly linked to student achievement. As is well known, the findings of these studies have been rather inconsistent and suggest that attempting to pinpoint effective individual inputs may not be feasible. In this inquiry, instead of following the example of previous studies, an attempt was made to identify underlying factors that would be related to the distribution of educational achievement. To this end, the exploratory

factor analysis of the school input variables was conducted for the purpose of identifying broader constructs than discrete singular attributes.

It is evident that the conditions that are generally accepted as prerequisites for the use of factor analysis, such as the number of observations per variable, the level of measurement of the variables, the reliability of the measures, and so forth, need to be carefully considered when attempting to identify underlying common elements of school input variables. Two conditions seemed especially critical in this study, the number of subjects and the reliability of the measures. It is evident that the limited number of subjects had an impact on the results of the factor analysis. A larger number of observations would probably have resulted in a more definitive factor structure. It is most likely that the limited reliability of the school input variables affected the factor analysis and resulted in a weak factor structure. However, providing that the limitations discussed above are considered, the findings of the study suggest that the use of factor analysis and subsequent multiple regression analysis in the way that is proposed here is an appropriate method for investigating the equity of educational outcomes. Factor analysis can be used for reducing the dimensionality of the variable structure and for alleviating the problem of multicollinearity should it be encountered. Furthermore, factor analysis can assist in unearthing potential underlying constructs of individual variables. Multiple regression analysis, in turn, offers a way of operationalizing such concepts as equity and exploring its association with school inputs.

Findings on Equity

As to the findings on equity of educational achievement, it is evident that, in this group of classrooms, the strength of the relationship between student

achievement and background varied considerably from one classroom to another. That is to say, given the definition of equity in this study, the equity of educational outcomes varied in these classrooms.

Similarly, the strength of the relationship between achievement and each individual background variable also varied depending on the variable or the classroom. Even when the confusing impact of the above mentioned suppressor effect and the scaling of the variables are considered, the relationship between achievement and student background was unusual. The association between achievement and ability was much weaker in many cases than what might have been expected (in classrooms 3, 5, 12, 13, 14, and 24 in particular).

The relationship between SES and achievement was inconsistent. In five classrooms, the actual correlation between achievement and SES was positive although small and non-significant, which is contrary to the findings from elsewhere. For these five cases, there is no readily available explanation for the unusual relationship between achievement and SES. However, on a purely conjectural basis, one might speculate that, for example, the teachers might have paid special attention to the low SES students, or given them extra help, or in some other way differentiated their instructional approaches to the extent that these students benefitted more than other students.

Overall, the relationship between PSEN status and achievement in these classrooms was as one might expect, disregarding the suppressor effect in classrooms 19 and 26.

The signs of the b-weights for race varied. In the 19 classrooms in which there were minority students, 10 of the regression coefficients were negative and 9 were positive. The only b-weight that was statistically significant ($p < .05$) was positive (classroom 24) indicating that, in this classroom, racial minority status

was associated with higher achievement. There was no statistically significant relationship between race and achievement in the rest of the classrooms.

It should be noted here again that race was coded as a dummy variable, white and non-white and, therefore, the category "non-white" most likely included students from various minority groups, which might explain, in part, the varying signs of the regression coefficients for race. As recent statistics on the achievement of ethnic groups in the nation indicate, student achievement varies according to ethnic origin. For example, students with Asian origin tend to have higher average achievement scores than blacks, Hispanics, and whites. It is possible that the composition of the non-white category in these classrooms varied to the extent that it could explain the varying signs for race in this study.

Obviously, the issue that needs to be considered here is the reliability of the measurement of the variables because an unreliable measurement could have been the reason for the unusual findings. With regard to achievement and ability, there is no apparent reason to doubt the reliability of these variables because in both cases, the tests were well-established instruments with known psychometric properties. Neither is there any particular reason to suspect the reliability of the other three background variables, race, PSEN status, and SES because it is hard to imagine that the teachers would have made mistakes in indicating these data for their students.

Another reason for the weak relationship between achievement and ability in some classrooms was clearly the restricted range of the ability or achievement scores or both. This appears especially to be the case in classroom 3. In this classroom, the average ability and achievement scores were very high (135.7 and 74.4, respectively) with a limited range (123-150 in ability and 66-77 in achievement) resulting in a low correlation between these variables. This problem, however, was not present in the majority of the classrooms.

The results of a regression analysis can also be affected for other reasons such as non-linearity of the relationship between the variables, or outliers that influence the slope of the regression line. When the results of the regression analyses in testing Hypothesis H1 were reviewed in this regard, neither of these factors appeared to have had a noticeable impact on the regression coefficients or their signs.

All in all, the unusual signs of the regression weights and the limitations regarding the range of the variables notwithstanding, the findings of the study are clear in terms of the equity of educational achievement in reading. The fact that none of the student background variables reached statistical significance at the .05 level in seven of the 30 classrooms strongly suggests that student achievement is not always closely related to student background as some early research studies on school effectiveness have claimed. Rather, it appears that, in some classrooms, student achievement and background are hardly at all related to each other. For example, classrooms 5, 12, 14, 18, 22, 28 and 29, the relationship between student achievement and background was relatively weak (R^2 <.30) and, therefore, the distribution of educational achievement in these classrooms can be considered equitable. In some other classrooms (4, 8, 9, 10, 11, 16, 17 and 21), the distribution was less equitable as indicated by a stronger relationship between student achievement and background (R^2 >.50).

Findings on School Effectiveness

The findings of the study in testing Hypothesis H2 were somewhat unexpected. When considering these findings it is important to remember that the concept of equity in this study was operationalized as the R^2 values

indicating the relationship between student achievement and background. The scaling of this variable was such that high R^2s indicated low equity and vice versa. Consequently, for an individual school input variable to be positively associated with equity, it should have had a negative regression weight. The same is true about the three factors, "Climate and expectations," "Hard work," and "Morale." For the variable, "Futility," the regression weight should have been positive due to the inverse scaling of this variable.

As a group, the school input variables explained a significant proportion, 46 percent, of the variance in the equity of educational achievement in this group of classrooms. Individually, however, none of these variables was positively associated with equity except "Time allocated for reading," but even this relationship was not statistically significant. The rest of the school input variables were not positively associated with equity as far as the regression coefficients are considered. In fact, five of them, "Teacher experience," "Training in teaching methods," "Practice," "Classroom climate and expectations," and "Hard work" had statistically significant inverse regression weights. The remaining three variables also had inverse b-weights but they were small and statistically nor-significant.

When the correlations between equity and school input variables were individually considered, "Time allocated for reading" had a negative correlation (-.09) with the dependent variable and, thus, was positively associated with equity as was mentioned earlier. Two of the five statistically significant variables, "Teacher experience" and "Hard work" also had an actual correlation with the dependent variable that was negative. The positive b-weights for these variables were, therefore, a result of the suppressor effect in the regression analysis. The rest of the statistically significant school input variables had an inverse correlation with equity; that is, when the value of "Training in teaching

methods," "Practice," and "Classroom climate and expectations" increased, equity of educational achievement decreased. The outcome was also the same for "Futility" irrespective of its actual negative correlation with the dependent variable due to the inverse scaling of this variable. (The b-weights for "Futility," "Class size," and "Morale" were not statistically significant.) A check for non-linearity and outliers did not reveal anything noteworthy in these regards.

These findings suggest that some of those variables that have conventionally been used in school effectiveness studies and have often been associated with improved student achievement may not be positively related to the equity of learning outcomes. It appears that school efforts such as providing training to the teachers in teaching methods, or spending more time in practicing reading, or improving classroom climate, or holding high expectations for the students might not at all improve the equity of students' educational outcomes. In fact, the findings of this study were that, in this group of classrooms, the opposite was true: the more the teachers had received training in teaching methods, and the more time was spent in practicing reading, the less equitable the learning outcomes were. Similarly, the better the classroom climate and the higher the expectations of the teacher, the lower the equity of student achievement was.

Implications of the Findings

As discussed above, the findings of the study clearly suggest that some of the school efforts that have been associated with student achievement in the past may not result in equitable student outcomes. In fact, some of these school inputs may be inversely associated with equity. Conceptually, this line of thought is plausible. If the equity of educational achievement were a result of

conventional school inputs such as teacher experience, training of the teachers, or class size, it would be relatively easy to achieve and much more commonplace than what it is now. The findings of this study imply that since these kinds of school efforts do not necessarily result in equity, the issue of obtaining equitable learning outcomes needs to be addressed from a new and different vantage point. It appears that there is a need to look for a new approach when the educational achievement of the disadvantaged is in question, including the investigation of those school input variables that have not commonly been used in these inquiries. In this regard, the intangible school efforts that some researchers have referred to might deserve a closer look.

The nationwide school improvement efforts that have been implemented in recent years focus on improving student achievement. In New York State, the goal of these efforts has been to improve both student achievement and the equity of educational outcomes. The approach that this state has taken is intended to bring a large majority of students (95 percent or more) to "a minimum academic mastery" defined by student achievement scores.[17] As a result, many school districts have implemented school improvement programs and, consequently, made gains in improving student achievement.[18]

Regardless of the success of these efforts, one might argue that the way to achieve truly equitable student outcomes may not be the same as to improve student achievement in general. There is a possibility that even if school improvement efforts were successful and all--or nearly all--students made progress and reached a certain minimum standard, the disadvantaged might still be behind. It could well be that the gap between the disadvantaged and the other students may not have narrowed as a result of these efforts but just moved to a different place, above the set standard. Experiences from some attempts to improve the learning outcomes of the disadvantaged seem to suggest just that. It

is well known that the efforts designed to help the disadvantged such as special preschool programs, enrichment, Sesame Street, and the like, have an impact on these students. However, it is equally well known that those children who do not necessarily need these programs also benefit from them and, therefore, the gap between the two groups remains the same.

One might conjecture that the key to equity is differentiation. This view is consistent with the conceptual background of equity as it is understood in this study. In the review of the literature on justice, ethics, and social values, the notion of equity was related to the idea of justice as defined by John Rawls. In his view, enhancing justice in society requires differentiation among individuals and compensation for the disadvantages that exist. Even though it is clear that philosophical positions do not always reflect reality, it could well be that, in this case, differentiation in providing educational offerings is the way to achieve equity. It seems justifiable to argue that if the disadvantaged students were to obtain equitable learning outcomes, the efforts that schools make need to be differentiated both quantitatively and qualitatively.

Throughout the years, various means have been employed in attempting to differentiate instruction for different students. Unfortunately, some of these efforts have not always resulted in the expected outcomes. Ability grouping is one such example.

The results of ability grouping are highly questionnable. In a recent review of 14 studies on comprehensive ability-grouped class assignment plans, Robert Slavin concluded that "assigning students to self-contained classes according to general achievement or ability does not enhance student achievement in the elementary school."[19] One might argue that this and other current practices need to be carefully reviewed as far as the achievement of the disadvantaged is concerned.

One possible way to quantitatively differentiate the delivery of educational programs is to vary the length of the time that is allocated for learning. This is supported, albeit very tentatively, by the finding of this study that the amount of time that students were exposed to learning was associated with equity. If schools were to produce equitable student outcomes perhaps they should vary, for example, the time that students spend in kindergarten. Similarly, the time allocated for various subjects at the elementary level should probably vary depending on what the students background is and what resources for learning they have at home. Yet another way to alter the length of the opportunity to learn is a summer school program for those who need additional time.

It also seems feasible that schools should employ qualitatively different means in improving equity. For example, tutoring, counseling and psychological services at the elementary level, alternative school programs, and so forth are some possible ways to differentiate educational offerings. In addition, the training that teachers receive should probably vary depending on what the composition of the student population is. Teachers should learn to alter their teaching styles according to their students. For example, it just might be that motivating a disadvantaged learner is very different from motivating the rest of the students.

Improving student achievement in general is without a doubt a commendable goal and the systematic efforts that have been undertaken to make progress in this respect are to be supported. However, it is suggested here that along the efforts that are aimed toward realizing general educational improvement, attention should also be focused on enhancing the equity of educational outcomes. The findings of this study suggest that these two might not be accomplished using the same means. It also appears that, at this point, very little is known about the equity of educational outcomes and even less

about how to achieve it. Much more research is needed in this area. In this respect, the overall outcomes of this study might be helpful. The definition of educational equity as the fairness of the distribution of educational achievement provides a feasible approach to addressing this issue. This conceptualization lends itself easily to an empirical investigation of an important topic in education today: reducing inequalities. It also seems that quantitative methods such as factor analysis and multiple regression analysis are appropriate methodological tools for these studies. Educational decision makers can also use this approach for assessing the effectiveness of actions for improving the distribution of educational outcomes.

Suggestions for Further Reseach

As was discussed earlier, most of the school inputs that were included in this study were not positively associated with equity. A logical follow-up question, then, is: What school inputs and dynamics are positively associated with equity?

The first step in obtaining new knowledge in this area would be to investigate the relationship between other school input variables and equity. If the results indicate that very few or none of these inputs are associated with equity, future research efforts should be directed toward identifying those school efforts and dynamics that are related to equity. However, it may not be feasible to try to pinpoint individual variables but, rather, to look for larger underlying constructs. In this respect, studies utilizing factor analysis might be productive.

An area that needs much more exploration is the use of qualitatively and quantitatively different school efforts in improving equity. For example, the length of kindergarten exposure for the disadvantaged and its relationship to

equity should be studied. Many other aspects of educational programs ranging from the organization of a school day to cooperative learning could be included in these inquiries.

The general methodology that was used in this study appears appropriate. However, regardless of what methods are used and what topics are researched, the measurement of the variables remains extremely important. A great care should be taken to ensure the reliability and validity of the measurement. For example, questionnaires presented to the teachers are probably not the most desirable way of collecting data. Actual recording of such data as the length of the time students are engaged in learning would most likely result in better measurement.

Similarly, more comprehensive measures are needed in describing student background. For example, in assessing the relationship between the family's socio-economic status and student achievement, better indicators than what are now available must be developed.

In summary, investigation of the equity of educational outcomes offers a fresh and potentially useful line of research in education. Carefully conducted inquiries in this area could be very beneficial to school improvement efforts because even though overall educational improvement may not necessarily result in equity, increasing equity might bring about overall improvement.

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